



Allen-Bradley

CompactFlash File System on Logix5000 Controllers

1756-L61, 1756-L62, 1756-L63,
1756-L64, 1756-L60M03SE

Application Solution

**Rockwell
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Important User Information

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Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING



Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

ATTENTION



Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:

- identify a hazard
 - avoid a hazard
 - recognize the consequence
-

SHOCK HAZARD



Labels may be on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

BURN HAZARD



Labels may be on or inside the equipment (e.g., drive or motor) to alert people that surfaces may reach dangerous temperatures.

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Purpose of This Manual

This manual describes how you can use the CompactFlash file system on Logix5000 controllers.

Who Should Use This Manual

You should use this manual if you program applications that use CompactFlash card and RSLogix 5000 programming software with the following Logix5000 controllers:

- ControlLogix controller

Additional Resources

This table lists Logix products and documentation that may be valuable as you program your application.

Related Documentation

Catalog Number	Title	Publication Number
1756-L61, 1756-L62, 1756-L63, 1756-L64, 1756-L60M03SE	Logix5000 Controllers Common Procedures Programming Manual	1756-PM001
1756-L61, 1756-L62, 1756-L63, 1756-L64, 1756-L60M03SE	Logix5000 General Instruction Set Reference	1756-RM041

To view or download these publications, go to:

<http://www.literature.rockwellautomation.com>.

To obtain a hard copy, contact your Rockwell Automation distributor or sales representative.

Notes:

CompactFlash Card Enhancements Overview

Introduction

This chapter reviews the enhancements for the CompactFlash file system.

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CompactFlash Card Enhancements

The CompactFlash file system has gone through several enhancements.

- **Version 11:** The CompactFlash card could only be used for saving project image files with the NVS feature.
- **Version 12:** The CompactFlash card stored firmware as well as project image files.
- **Version 16:** The CompactFlash card functionality has been extended to include a file system that can be used for storing tag values, recipes, log data, and other user data.

The CompactFlash file system as described in this document is available on the following Logix5000 controllers, with version 16.x or later.

ControlLogix Controller	Version
1756-L6X/A	16.x
1756-L6X/B	16.x
1756-L60M03SE	16.x

This document explains each feature and provides you with examples that illustrate how to use those features. After you read and understand this document and the examples, you will be able to add the CompactFlash file system functionality to any of your programs.

Sample File Compatibility

This document is compatible with the sample projects, version 3.2, dated January 2007.

- CF_Read_Write_V3_2.ACD
- CF_Read_Write_V3_2_Example.ACD

CompactFlash File System Features

The file system has the ability to perform a variety of operations to read or write data to the CompactFlash card. The following are the basic operations:

- Create a file
- Write to a file
- Read from a file
- Delete a file

There is an additional command, verification if a CompactFlash card is present, but as a user you will not access this, this runs as a background check.

For each of the basic operations of the file system, there are related functionality.

- Open a file
- Close a file
- Set the file pointer
- Calculate file checksums
- Verify file checksums
- Data parsing
- Error handling

The application code is set up to handle a file up to 4500 bytes in size.

For more information on how to increase file size, refer to Appendix D, Expand the Code to Support More than 4500 Bytes of Data.

Possible Applications of the CompactFlash File System

Using RSLogix 5000 software, version 16 or later, and using the application provided in this publication, you can read and write data to the CompactFlash card. This could include tag values, recipes, or data log information, just to name a few.

A possible application would be to store a collection of recipes on the CompactFlash card. Whenever a recipe needs data, it can be read from a file on the CompactFlash card. Then if changes were made to the recipe the data could then be written back to the CompactFlash card for later use.

CompactFlash cards can also be read and written to with a personal computer, using a CompactFlash card reader. However, using the methods described in this document, tag values will be written out as binary data to the CompactFlash card.

Attempting to open the file in a text editor will work, but the contents displayed will be the ASCII equivalent of the binary data. The application will not allow for files to be created on a personal computer and then read into the controller, because checksums are embedded into the data. If you create a file on the personal computer, it will not have the checksums embedded. When the data is read it will fail the checksum test.

There are numerous possibilities with this feature, but there are some clear restrictions that are explained in Chapter 2, CompactFlash File System Restrictions.

Notes:

CompactFlash File System Restrictions

Introduction

This chapter describes the restrictions of the CompactFlash file system.

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Restrictions of the File System

The following are the restrictions of the CompactFlash file system.

Number of Open Files

The total number of open files at one time is one.

Maximum Data Per Message

The maximum amount of data that can be read or written to the CompactFlash card at one time using the application is 450 bytes, this is because we are using CIP Generic Messages. Attempts to read or write more than this amount at one time is not permitted by the application code. If the code is modified to access more than 450 bytes, the data will not be read or written to the CompactFlash card. When you need to access more than 450 bytes of data, multiple calls to the file system must be performed and are handled by the application code.

Removal and Insertion of CompactFlash Card

The application does not support the removal or insertion (RIUP) of the CompactFlash card when a CompactFlash command is active.

Minimum File Size/Resolution

The minimum file size supported is 450 bytes. If you create a file and write 4 bytes to the file the application will actually write 450 bytes. The same concepts applies for reads and writes. If you read or write 500 bytes, 900 bytes will be read or written.

Memory Resources and Performance

The subroutines described in this document depend on messaging to perform the required operations to the CompactFlash card. These operations use the same memory resources that might be needed to perform other messaging. The performance of the CompactFlash card operations will be affected by:

- the communications system overhead time slice and amount of other messaging or HMI communications that are occurring in the controller. You can configure the System Overhead Time Slice from the Controller Properties dialog.
- the task structure of the program. Motion, periodic tasks, or event tasks slow performance when accessing the CompactFlash card.

Refer to Appendix B, Performance Data for more information.

Controllers Supported

Only the Logix series of controllers support read/write access to the CompactFlash card using this feature.

Limited Life

Due to the limited life of any CompactFlash card, write to the card only when necessary. Do not write to the CompactFlash card every program scan. Write to the card only at predetermined intervals, such as a shift change.

Read or Write Portions of a File

The application code does not support reading or writing to portions of a file that already exists. Only the entire file can be read or written. If a part of the file needs to be modified, read the entire file from the CompactFlash card, make changes, and then write the file back to the card.

Number of Files that Can Be Created

Currently, the application only supports creating files on the root directory. Because the FAT16 format is used on the CompactFlash card you are limited to 250 files. This is a Microsoft product limitation.

CompactFlash Commands

Introduction

This chapter describes four of the CompactFlash commands, the ControlFlash Data Working Tag, and how to determine the number of bytes to read or write.

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The file system has the ability to perform a variety of operations to read or write data to the CompactFlash card. There are four basic commands that you can access:

- Create a file
- Write to a file
- Read from a file
- Delete a file

There is an additional command, verification if a CompactFlash card is present, but as a user you will not access this, this runs as a background check.

CF_Data_Working Tag

Before explaining the four commands, you need to understand the layout of a key tag in the application. The CF_Data_Working tag, a user-defined data type tag (UDT), is at the program scope.

This is an example of a user-defined data type tag or UDT.

Scope: MainProgram Show... Show All				
Name	Style	Data Type	Description	
CF_Data_Working		CF_File_Structure		
+ CF_Data_Working.File_Name		String140	This is the file name. Remember t...	
+ CF_Data_Working.String_Length	Decimal	INT		
+ CF_Data_Working.File_Handle	Decimal	DINT	Do not manipulate this value	
+ CF_Data_Working.Bytes_to_RW	Decimal	DINT	Enter the number of bytes you wa...	
+ CF_Data_Working.Actual_Bytes_to_RW	Decimal	DINT	Do not manipulate this value	
+ CF_Data_Working.Chunks_to_RW	Decimal	DINT	Do not manipulate this value	
+ CF_Data_Working.Point_Method	Decimal	DINT	Do not manipulate this value	
+ CF_Data_Working.Pointer_Offset	Decimal	DINT[2]	Do not manipulate this value	
+ CF_Data_Working.Point_Move_Length	Decimal	DINT	Do not manipulate this value	
+ CF_Data_Working.Point_Last_Position	Decimal	DINT	Do not manipulate this value	
+ CF_Data_Working.Commands	Decimal	DINT	Do not manipulate this value	
+ CF_Data_Working.Spare	Decimal	DINT		
+ CF_Data_Working.Data	Decimal	SINT[4950]	This is the data that is written/read	

When a command is executed, the routines use this tag to get all the information needed to perform the command, such as file name, data, or number of bytes to read or write. The table below is a layout of the UDT in the file structure area.

Name	Data Type	Style	Description
+ File_Name	String140		This is the file name. Remember to ac
String_Length	INT	Decimal	
File_Handle	DINT	Decimal	Do not manipulate this value
Bytes_to_RW	DINT	Decimal	Enter the number of bytes you want ot
Actual_Bytes_to_RW	DINT	Decimal	Do not manipulate this value
Chunks_to_RW	DINT	Decimal	Do not manipulate this value
Point_Method	DINT	Decimal	Do not manipulate this value
Pointer_Offset	DINT[2]	Decimal	Do not manipulate this value
Point_Move_Length	DINT	Decimal	Do not manipulate this value
Point_Last_Position	DINT	Decimal	Do not manipulate this value
Commands	DINT	Decimal	Do not manipulate this value
Spare	DINT	Decimal	
Data	SINT[4950]	Decimal	This is the data that is written/read

The UDT tag's type is called `CF_File_Structure`. This will be important if you create a `Recipe_Manager`. The only 3 tags you will need to manipulate in the UDT are:

- **File_Name**

The name of the file that will be on the CompactFlash card. This name can be up to 140 characters in length. The file name must include a file extension. The .xxx is included in the 140 characters. For example, `testfile1.dat` would be an 11-character file name. The format of the filename follows standard Microsoft file naming conventions.

- **Bytes_to_RW**

The number of bytes that you want to read or write to a file.

- **Data**

The SINT array is where you place the data that you want to write or where data read will be put. The baseline application supports up to 4500 bytes of data, but can easily be expanded.

Refer to Appendix D, *Expand the Code to Support More than 4500 Bytes of Data*, for more information.

Do not manipulate the other tags. They are used by the routines as they execute; manipulating them could cause unexpected changes to the file currently opened.

Create Command

Use the Create command when a file does not exist on the CompactFlash card and you want to create one. A file must exist on the CompactFlash card before you can use the other three commands.

The Create command is broken down into four commands:

- Sets the file attribute parameters.

You do not need to manipulate the file attribute parameters.

- Creates the file.

When a Create command is performed, the file is created and then opened.

- Closes the file.
- Error handling is performed, if needed.

Set Up the Create Command

To set up the Create command, define the filename including the file extension, for example, testfile1.dat. To execute the Create command, set the execute_CF_Create_File bit. The application code resets this bit.

Refer to Chapter 4, Example Application for complete instructions.

Write Command

Use the Write command to write data to the CompactFlash card. A file must exist on the CompactFlash card before executing this command.

The Write command is broken into 11 commands:

- Data parsing

Only 450 bytes can be written at one time to the file. Therefore, writing to the file is broken down into 450 byte chunks.

This moves the data into the data_to_write array from the data array in the CF_Data_Working UDT, putting in the place holders for the checksums. It also verifies that all arrays used are large enough to handle the data.

- checksum calculations

This calculates the checksum for each 450 byte chunk of data and places it into the place holders created in Data parsing.

- The file is open.
- The file pointer is set.
- The data is written.
- The file is closed.
- The file is opened.
- The file is read.

Only 450 bytes can be read at one time from the file. Therefore, reading from the file is broken down into 450 byte chunks. This moves the data into the data_read array.

- The checksums are verified and the data in `data_to_write` and `data_read` are compared to make sure they are equal.

TIP

If the checksums are not calculated, compared, and parsed, the file is closed and the write sequence is restarted from the beginning.

The application will attempt to write a file four times. After the fourth failure, a checksum error is set.

- The file is closed.
- Error handling is performed, if needed.

Set Up the Write Command

To set up the write command, you need to set the bit `execute_CF_Write_Data`. The application code handles resetting this bit.

1. Define a file name including a file extension, for example, `testfile1.dat`.
2. Enter the number of bytes you want to write to the file.
3. Move the data to be written in the `CF_Data_Working` UDT into the `Data` array.

We recommended that you clear the data array before moving the data into the array. This will clear out any data from previous read or write commands.

Refer to Chapter 4, Example Application for complete instructions.

Read Command

The Read command is used when you want to read data from the CompactFlash card. A file must exist on the CompactFlash card before executing this command.

The read command is broken into six commands:

- The file is open.
- The file pointer is set.
- The file is read.

Only 450 bytes can be read at one time from the file. Therefore, reading from the file is broken down into 450 byte chunks. This moves the data into the `data_read` array.

- The checksums are calculated and compared to those in the file. The data is then parsed into the `Data` array in the `CF_Data_Working` UDT.

TIP

If the checksums are not calculated, compared, and parsed, the file closes and the read sequence is restarted from the beginning.

The application will attempt to read the file four times. After the fourth failure a checksum error is set.

- The file is closed.
- Error handling is performed, if needed.

Set Up the Read Command

To set up the read command, you need to set the bit `execute_CF_Read_Data`. The application code handles resetting this bit.

1. Define a file name including a file extension, for example, `testfile1.dat`.
2. Enter the number of bytes you want to read from the file.
3. Move the data from the data array in the `CF_Data_Working` UDT when the read is completed.

Only 450 bytes can be read at one time from the file. Therefore, reading from the file is broken down into 450 byte chunks. This moves the data into the `data_read` array.

We recommended that you clear the data array before moving the data into the array. This will clear out any data from previous read or write commands.

Refer to Chapter 4, Example Application for complete instructions.

Delete Command

Use the Delete command when a file needs to be deleted from the CompactFlash card. A file must exist on the CompactFlash card before you can use the Delete command.

The delete command consists of two commands:

- Delete the file.
- Error Handling is performed, if needed.

Set Up the Delete Command

To set up the Delete command:

- define a filename including a file extension, for example, testfile1.dat.
- set the bit `execute_CF_Delete_File`. The application code handles resetting this bit.

Refer to Chapter 4, Example Application for complete instructions.

Determine the Number of Bytes to Read or Write

Tags of any data type, including arrays, user-defined types (UDT), and arrays of UDT tags can be read and written to the CompactFlash card.

When reading and writing data to the CompactFlash card, you need to know how many bytes are actually being read or written. The following chart indicates the type and size of the atomic data types. The minimum memory allocation for a tag is 4 bytes. When you create a tag that stores data that requires less than four bytes, the controller allocates four bytes, but the data only fills the part it needs.

Data Type	Bits					
	3116		158		710	
BOOL	Not used				0 or 1	
SINT	Not used				-128...+127	
INT	Not used		-32,768...+32767			
DINT	-2,147,483,648...+2,147,483,647					
REAL	-3.40282347E ³⁸ ...-1.17549435E ⁻³⁸ (negative values) 0 1.17549435E ⁻³⁸ ...3.40282347E ³⁸ (positive values)					

For example, if one DINT type tag value is being written to the CompactFlash card, 4 bytes is the amount of data that will be written. If an array of DINT tags is being written, the number of bytes being written will be 4 times the size of the array.

For example, the tag MYDINTS[100] will be 4 times 100 elements, or 400 bytes of data. Similarly, if a UDT is used, 1 instance of that UDT will be the sum of the sizes of all the data types within the structure.

TIP

When reading or writing to the CompactFlash card, it is best to use UDT tags. This lets you mix different data types together and lets you know the number of bytes that will need to be transferred to and from the card.

The following is a UDT that is the recipe for making waffles.

Name:

Recipe_Data

Description:

Recipe for making waffles

Members:

Data Type Size: 72 byte(s)

	Name	Data Type	Style	Description
	Number_of_Eggs	DINT	Decimal	
	Cups_of_Oil	REAL	Float	
	Cups_of_Water	REAL	Float	
	Cups_of_Milk	REAL	Float	
	Cups_of_Mix	REAL	Float	
	Add_Blue_Berries	BOOL	Decimal	
	Add_Choc_Chips	BOOL	Decimal	
+	Mix_Time	TIMER		
+	Cook_Time	TIMER		
+	Cook_Temperature	TIMER		
+	Cool_Time	TIMER		

As you can see, the total size of the recipe is 72 bytes. This means that you would want to read or write 72 bytes of data to the CompactFlash card. This would be entered into the Bytes_to_RW element of the CF_File_Structure UDT.

Example Application

Introduction

You should now have a good understanding of the basics using the CompactFlash file system. This example application brings all the concepts together.

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Requirements

You must have:

- the RSLogix 5000 software, version 16.00 or later, installed and open.
- a CompactFlash card installed. The application detects if one is present.

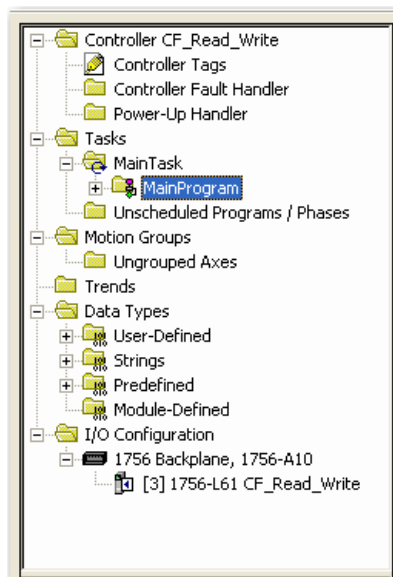
Configure Message Instructions

The majority of this configuration has already been performed for you in the ACD file. The only configuration you need to do is set the controller slot number.

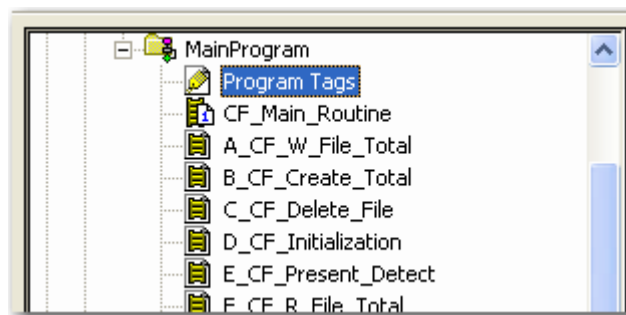
Set the Controller Slot Number

1. Open the project CF_Read_Write_V3_2.ACD

2. Open the MainPrograms tags.

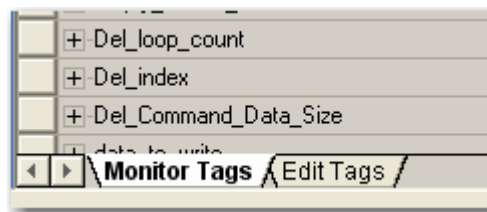


3. Expand the MainPrograms tags.

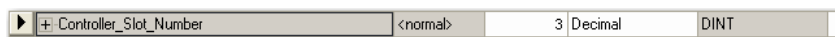


4. Double-click Program Tags.

Make sure the Monitor Tags tab is selected in the tag editor.



5. Sort the tags by Name.
6. Find the tag Controller_Slot_Number.



7. Enter the slot number where the controller will be located in the value column.

When the application enters Run mode, the D_CF_Intialization routine executes. The paths for all the message instructions will be modified to contain the slot number you just entered. You can add a new rung zero to the D_CF_Intialization routine to move the slot number into the tag Controller_Slot_Number.

8. Download the project to the controller and go online.
9. Put the controller into Run mode.

Create a File on the CompactFlash Card

Before you can perform any read or write commands to a file, you must create the file on the CompactFlash card first.

1. Open the MainPrograms tags.

Make sure the Monitor Tags tab is selected in the tag editor.

2. Sort the tags by Name.
3. Find the tag CF_Data_Working.

This is a user-defined data type (UDT).

4. Click the + next to the tag to expand the CF_Data_Working tag.

The FileName element of the UDT CF_Data_Working needs to be modified.


FileName, as it implies, is the name of the file you want to perform an operation on, in this case create. The file name can be up to 140 characters in length. You must include a file extension.

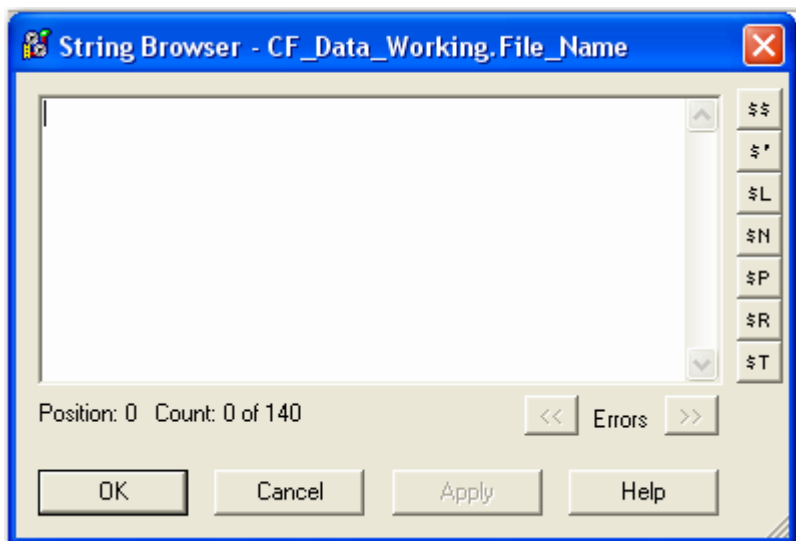
5. Click in the value field.



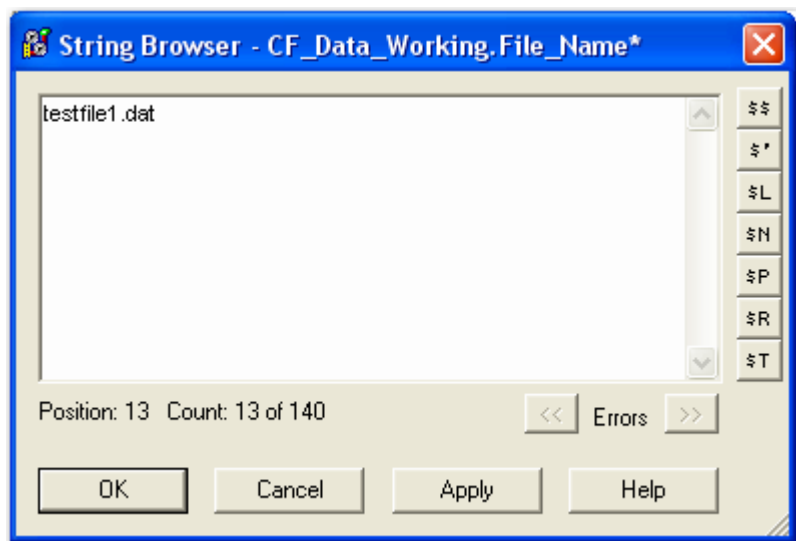
The Browse button appears.



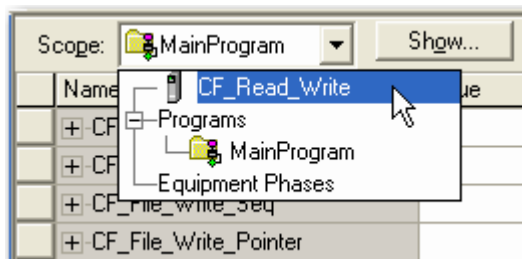
6. Click Browse  and the string browser window displays.



7. Enter testfile1.dat and click OK.



8. Switch the Scope to CF_Read_Write in the tag monitor to view the Controller Scoped tags.



9. Sort the tags by name.
10. Find the tag `execute_CF_Create_File`.
11. Enter a 1 in the value field and press Enter.

The tag goes back to a 0. This indicates that the application has attempted to create your file.

12. Find the tag `CF_Create_Seq_Status`.
13. Click + to expand the tag.

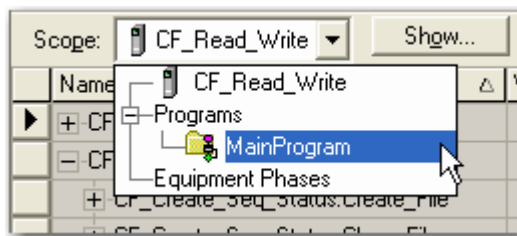
This is a user-defined data type (UDT). As the tag name indicates, this will give you status on the create file sequence. There is an element of the UDT called `Overall_Status`. At this point, it should be equal to 1. This means that the file was created successfully.

If another value is present, refer to AppendixC, Troubleshoot the CompactFlash File System.

Write Data to the CompactFlash Card

Set up how the program is going to write the data to the CompactFlash card.

1. Switch to the MainPrograms tags.



Make sure the Monitor Tags tab is selected in the tag editor.

2. Sort the tags by Name.
3. Find the tag CF_Data_Working.

This is a user-defined data type (UDT).

4. Click + to expand the tag.

[-] CF_Data_Working	{...}
+ CF_Data_Working.File_Name	'testfile1.dat'
+ CF_Data_Working.String_Length	0
+ CF_Data_Working.File_Handle	0
+ CF_Data_Working.Bytes_to_RW	0
+ CF_Data_Working.Actual_Bytes_to_RW	0
+ CF_Data_Working.Chunks_to_RW	0
+ CF_Data_Working.Point_Method	0
+ CF_Data_Working.Pointer_Offset	{...}
+ CF_Data_Working.Point_Move_Length	0
+ CF_Data_Working.Point_Last_Position	0
+ CF_Data_Working.Commands	0
+ CF_Data_Working.Spare	0
+ CF_Data_Working.Data	{...}

Leave the filename the same as the previous section, testfile1.dat. There is an element in the UDT called CF_Data_Working.Bytes_to_RW. This tells the application how many bytes in this case will be written to the file.

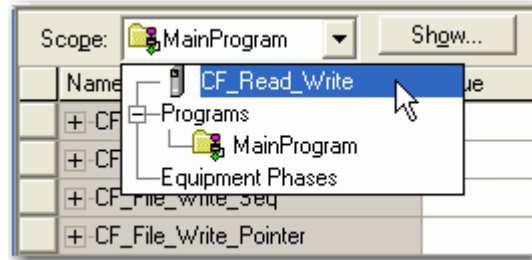
5. Find CF_Data_Working.Bytes_to_RW and enter a value of 450.

This means that 450 bytes will be written to the file testfile1.dat.

6. Expand the data element in the UDT, (CF_Data_Working.Data).

This array holds the data to be written to the file.

7. Enter a value of 100 in the first element of the Data array.
8. Switch the Scope to CF_Read_Write in the tag monitor to view the Controller Scoped tags.



9. Sort the tags by name.
10. Find the tag execute_CF_Write_Data.
11. Enter a 1 in the value field and press Enter.

The tag will go back to a 0. This indicates that the application has attempted to write to your file.

12. Find the tag CF_Write_Seq_Status and click + to expand the tag.

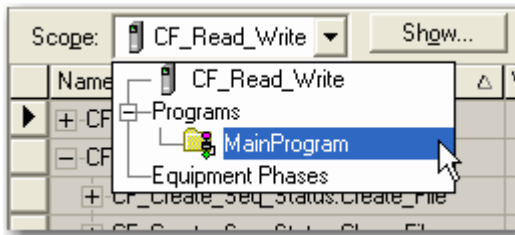
This is a user-defined data type (UDT). As the tag name indicates, this will give you status on the write file sequence. There is an element of the UDT called Overall_Status. At this point, it should be equal to 1. This means that the file was written successfully.

If another value is present, refer to AppendixC, Troubleshoot the CompactFlash File System.

Read Data from the CompactFlash Card

Determine how the program is going to read the data from the CompactFlash card.

1. Switch to the MainPrograms tags.



Make sure the Monitor Tags tab is selected in the tag editor.

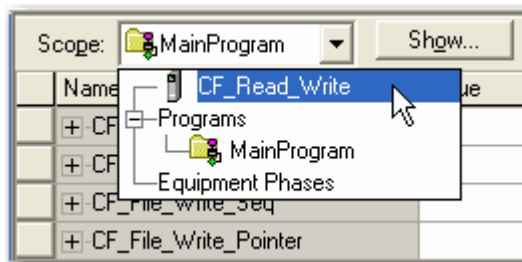
2. Sort the tags by Name.
3. Find the tag CF_Data_Working.

This is a user-defined data type (UDT).

4. Click + to expand the tag.
5. Use the file name from the previous section, testfile1.dat.

The UDT element Bytes_to_RW remains set at 450. The UDT element called Bytes_to_RW tells the application how many bytes in this case will be read from the file.

6. Enter a value of 127 in the first element of the data array, (CF_Data_Working.Data).
7. Switch to view Controller Scoped tags in the tag monitor.



8. Sort the tags by name.
9. Find the tag execute_CF_Read_Data.

10. Enter a 1 in the value field and press Enter.

The tag will go back to a 0. This indicates that the application has attempted to read from your file.

11. Find the tag CF_Read_Seq_Status and click + to expand the tag.

This is a user-defined data type (UDT). As the tag name indicates, this will give you status on the read file sequence. There is an element of the UDT called Overall_Status. At this point, it should be equal to 1. This means that the file was created successfully.

If another value is present, refer to AppendixC, Troubleshoot the CompactFlash File System.

12. Switch to view MainProgram Scoped tags in the tag monitor.

13. Find the tag CF_Data_Working.

This is a user-defined data type (UDT).

14. Click + to expand the tag.

15. Expand the SINT array Data in the UDT.

Earlier in this section, you entered a value of 127. The value is now 100. This is what you wrote to the file testfile1.dat in the last section and was read back.

Delete a File on the CompactFlash Card

Determine how the program is going to delete a file from the CompactFlash card.

1. Open the MainPrograms tags.

Make sure the Monitor Tags tab is selected in the tag editor.

2. Sort the tags by Name.

3. Find the tag CF_Data_Working.

This is a user-defined data type (UDT). Expand this by clicking in the + next to the tag. There are no elements of the UDT CF_Data_Working that need to be modified. The file name testfile1.dat is already entered. You want to delete this file.

4. Switch to view Controller Scoped tags in the tag monitor.
5. Sort the tags by name.

6. Find the tag execute_CF_Delete_File.
7. Enter a 1 in the value field and press Enter.

The tag will go back to a 0. This indicates that the application has attempted to delete your file.

8. Find the tag CF_Delete_Seq_Status and click + to expand the tag.

This is a user-defined data type (UDT). As the tag name indicates, this will give you status on the file sequence. There is an element of the UDT called Status. It should be equal to 1. This means that the file was deleted successfully.

If another value is present, refer to AppendixC, Troubleshoot the CompactFlash File System.

Build an Example

You will build an example application with the waffle recipe from the last chapter.

1. Open the file CF_Read_Write_V3_2_Example.ACD.

This code will handle four recipes.

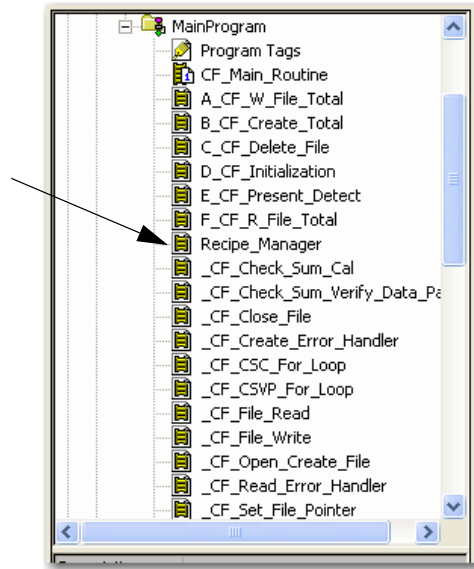
In the controller organizer under the MainProgram, you will see a routine called Recipe_Manager. This routine shows a basic recipe manager and how to interface into the baseline CompactFlash application.

Rung zero is used to make sure that you do not try and access two recipes at the same time or change a CompactFlash command when one is currently executing. All you would need to do is enter a value of 1, 2, 3, or 4 in Recipe_Number and a value of 1 to 4, depending on the CompactFlash command you want into Recipe_Command.

1 = create
2 = write
3 = read
4 = delete

There are four rungs remaining; each rung is for a different recipe. In this example, you are only going to look at one of them.

2. Open the Recipe_Manager routine.



3. Look at the next rung (rung 1).

The first conditions determine that this recipe and a command have been selected. After this there are 5 branches.

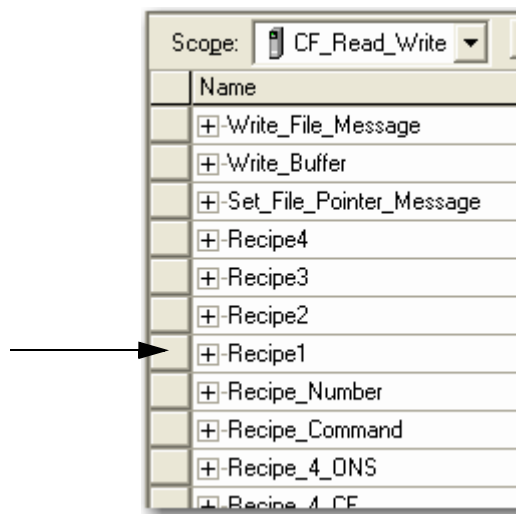
Branch	Description
1	Handles the command to write data to the CompactFlash card.
2	Handles creating the file on the CompactFlash card.
3	Handles the reading of data from the CompactFlash card and placing it into the Recipe.
4	Handles deleting the file on the CompactFlash card.
5	Handles clearing the Recipe_Manager for the next recipe and command.

Set Up Recipe Data

The next item to do is to set the application to perform commands to the CompactFlash Card. First you need to set up recipe data to store to the card.

1. Open the Controller Tags from the controller organizer.
2. Click Monitor Tags.

3. Scroll down until you find the tag Recipe1.



This is the UDT (Recipe Data) we discussed in the previous chapter.

4. Expand the tag and enter some data.

+ Recipe1.Number_of_Eggs	10	Decimal
Recipe1.Cups_of_Oil	2.0	Float
Recipe1.Cups_of_Water	2.0	Float
Recipe1.Cups_of_Milk	1.0	Float
Recipe1.Cups_of_Mix	12.0	Float
Recipe1.Add_Blue_Berries	1	Decimal
Recipe1.Add_Choc_Chips	1	Decimal

Earlier we discussed a program scope tag called CF_Working_Data. When a command is executed, the routines use this tag to get all information, such as file name, data, number of bytes to read or write.

In the CompactFlash Commands chapter, we manipulated data directly in this tag, but since we are now interested in handling multiple files, we will not. We will create new tags that have this type for each recipe. The Recipe_Manager code will handle the copying of this data.

5. Find the tag Recipe_1_CF in the controller organizer.
6. Expand the tag.

The first element to manipulate will be the File_Name.

7. Enter recipe1.dat.

Remember to use a file extension.

8. Define how many bytes you want to read/write to the file.

From the previous section, a waffle recipe was 72 bytes in size.

9. Enter 72 in the tag Bytes_to_RW.

The last piece of data to manipulate is the Data. You will copy the data from the waffle Recipe1 into this array. This is done in the Recipe_Manager code.

TIP

Remember to set the tag controller_slot_number and to make sure a CompactFlash card is installed in the controller.

10. Save the project and download it to the controller.

11. Go online with the controller.

You are now ready to read and write your recipe data to the CompactFlash card.

12. Open the Controller tags and go to the Monitor tab.

13. Look for the tags Recipe_Commmand and Recipe_Number.

You will use the first recipe as an example.

Create the File

Tell the Recipe_Manager routine to create a file.

1. Enter a value of 1 in the Recipe_Number tag.

This tells the Recipe_Manager to work with Recipe1.

2. Enter a value of 1 in the Recipe_Command tag.

This tells the Recipe Manager to create the file.

Once the command has completed the tags Recipe_Number and Recipe_Commmand will be set to zero.

Write the Recipe

Write the recipe data to the CompactFlash card. You entered data into Recipe1 before you download to the controller.

1. Enter a value of 1 in the Recipe_Number tag.

This tells the Recipe_Manager routine to work with Recipe1.

2. Enter a value of 2 in the Recipe_Command tag.

This tells the Recipe_Manager to write to the file. Once the command has completed, the tags Recipe_Number and Recipe_Command will be set to zero.

Read the Recipe

Before you read the recipe from the CompactFlash card, you need to clear out the values you entered earlier.

1. Go to the tag Recipe1 and clear out the values you entered earlier.

2. Enter a value of 1 in the Recipe_Number tag.

This tells the Recipe_Manager to work with Recipe1.

3. Enter a value of 3 in the Recipe_Command tag.

This tells the Recipe_Manager to read from the file.

Once the command has completed, the tags Recipe_Number and Recipe_Command will be set to zero.

Now look back in the tag Recipe1 the values have been read from the CompactFlash card and the values have been restored.

Delete the Recipe

Tell the Recipe_Manager routine to delete the file.

1. Enter a value of 1 in the Recipe_Number tag.

This tells the Recipe_Manager to work with Recipe1.

2. Enter a value of 4 in the Recipe_Command tag.

This tells the Recipe_Manager to delete a file. Once the command has completed, the tags Recipe_Number and Recipe_Command will be set to zero.

Format a CompactFlash Card

Introduction

This appendix reviews how to format a CompactFlash card with a CompactFlash Card Reader or using RSLogix5000 software.

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Format RSLogix 5000 Software and a Logix5000 Controller with CompactFlash Support	37

Requirements

To use the information described in this document, it is necessary to have the CompactFlash card formatted to a FAT16 file system. Allen-Bradley CompactFlash cards (1784-CF64) are pre-formatted to a FAT16 file system and are ready to use. If the CompactFlash card needs to be formatted, it can be done two ways: by using a personal computer with a CompactFlash card reader or by using RSLogix 5000 software and a Logix5000 controller with CompactFlash support.

Format with a Personal Computer and a CompactFlash Card Reader

The card can be formatted using a Windows-based operating system on a personal computer with a CompactFlash card reader. The following steps illustrate how to do this using Windows XP Professional. If another version of Windows is being used, the steps should be similar. Detailed steps can be found in Windows online help or in the instruction manual.

1. Insert the CompactFlash card into the CompactFlash reader.
2. Go to My Computer using the icon on the desktop.
3. Right-click the drive corresponding to the CompactFlash reader and select Format.

The following screen appears.



4. Choose FAT from the File system pull-down menu.
5. Enter a volume label, if desired.
6. Click Start.

The card will now be formatted and, once complete, the card is ready for use.

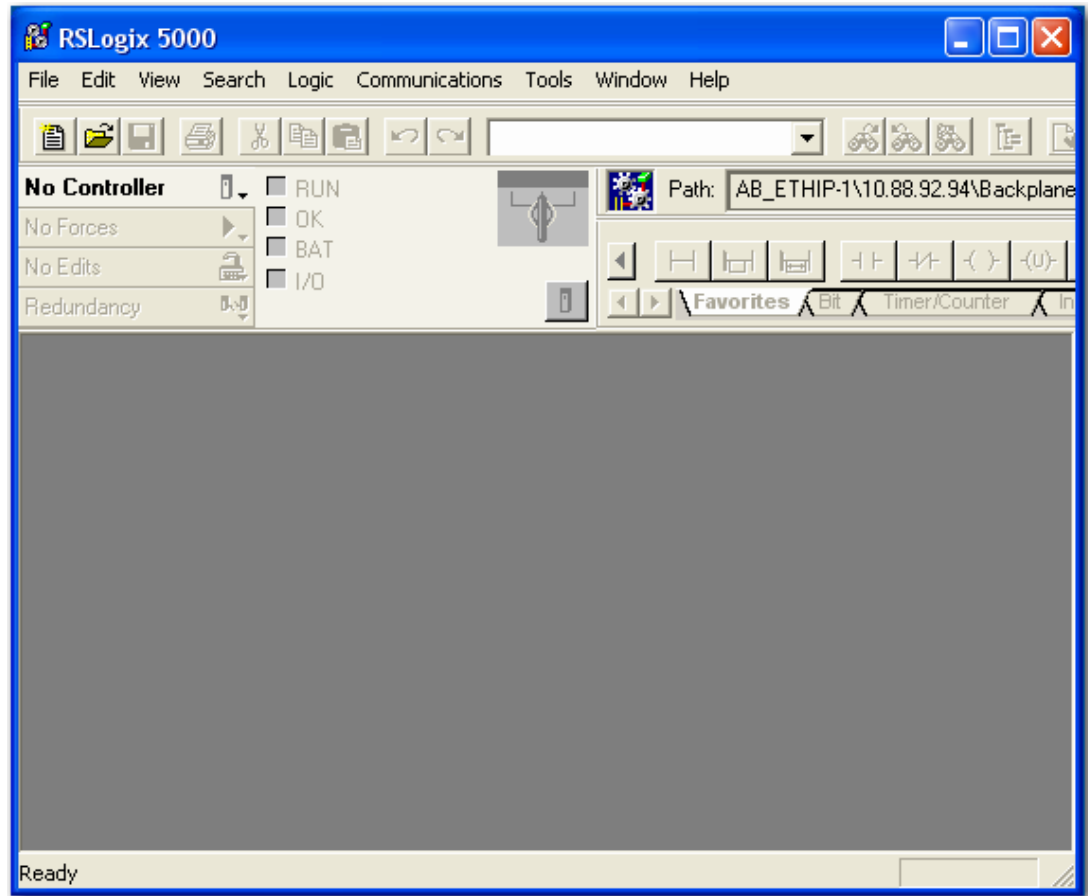
The second method formats the card only if it is unformatted or incorrectly formatted. In both cases, if the card is formatted, all data on the card will be lost.

Format RSLogix 5000 Software and a Logix5000 Controller with CompactFlash Support

The card can also be formatted using RSLogix 5000 software and a Logix5000 controller with CompactFlash Support.

1. Open RSLogix 5000 software, click Start > Programs > Rockwell Software > RSLogix 5000 Enterprise Series > RSLogix 5000.

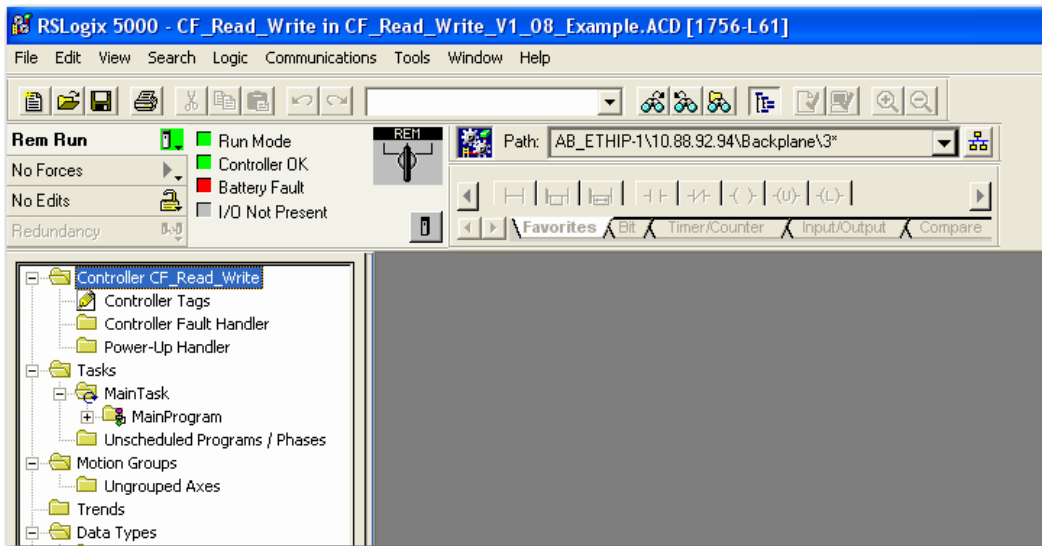
The following screen appears.



2. Select File -> Open.
3. Navigate to the location of CF_Read_Write_V3_2 or any other file that is version 16 or later.

4. Double-click the file to open it.

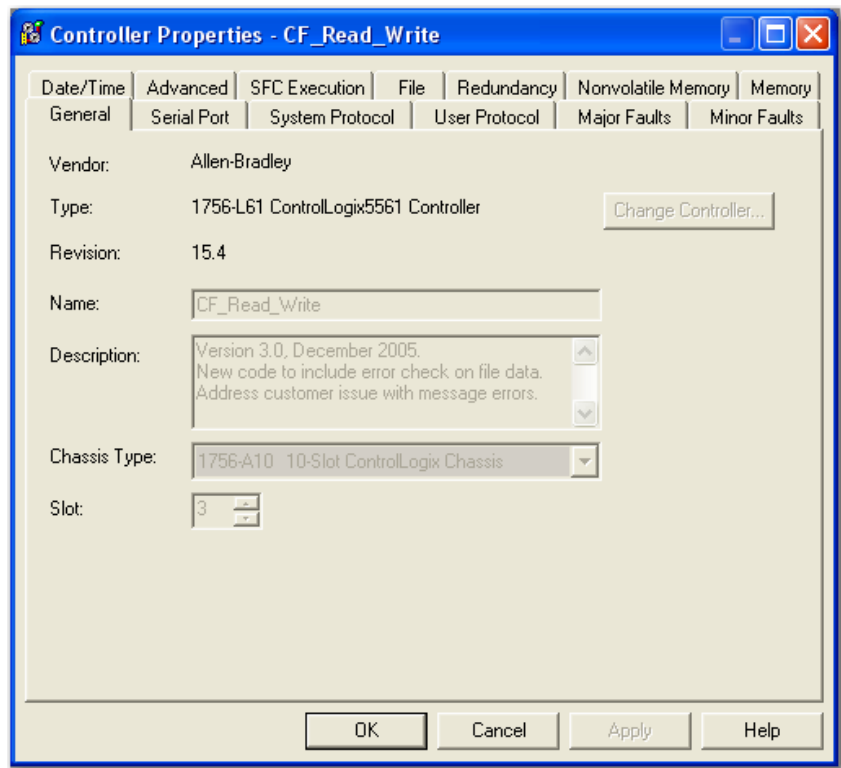
The following window appears.



Be sure that the controller is Online. Instructions for bringing a controller online can be found in the RSLogix 5000 software help files.

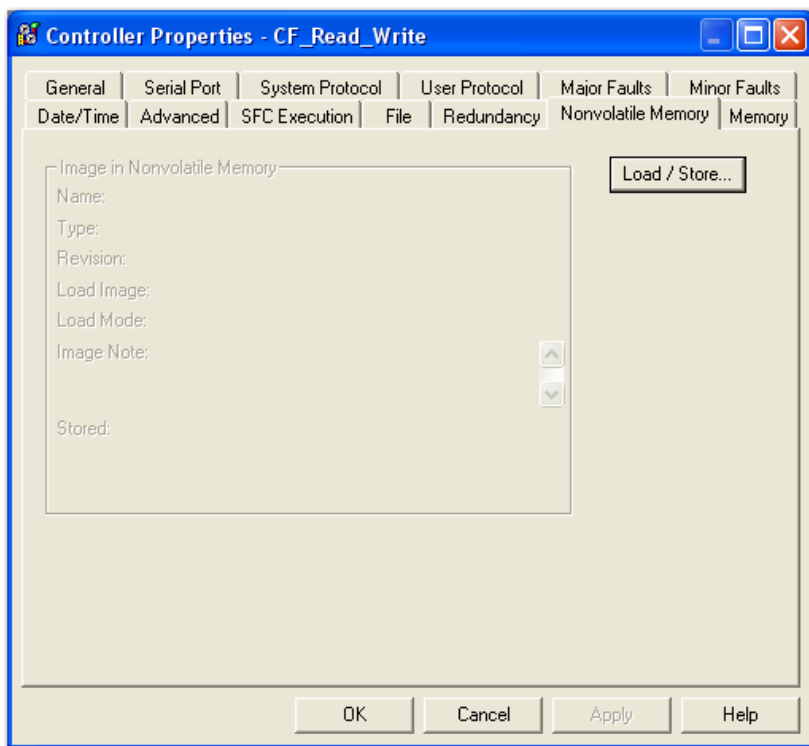
5. Right-click the Controller folder in the Controller Organizer and select Properties.

The following screen appears.



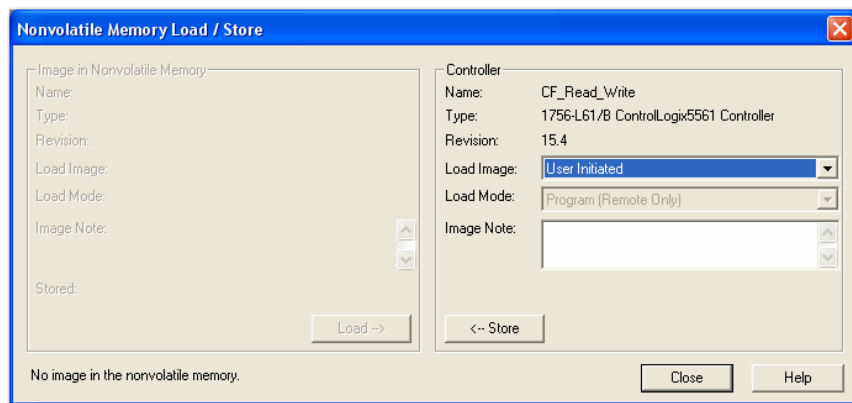
6. Click the Nonvolatile Memory tab.

The computer screen should look similar to the following.



7. Click Load/Store.

8. Make sure that the controller is in Program mode.



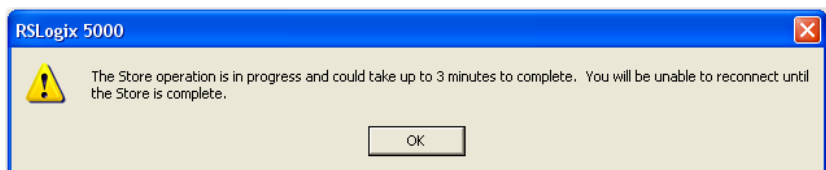
9. Click Store.

The following message box appears.



10. Click Yes.

11. Click OK in any dialogs that may appear.



The CompactFlash card formats to a FAT16 file system and the current project image file is stored on the CompactFlash card. The card is now ready for use.

Notes:

Performance Data

Introduction

This appendix describes performance data of the CompactFlash card. All tests were done with Rockwell Automation 1784-CF64 Revision BO1 cards. Performance with third party CompactFlash cards will vary.

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TIP

The application described in this document depends on messaging to perform operations, such as open, read, or write, on the CompactFlash card.

Therefore, data transfer rates will be affected by the communications time slice and amount of other messaging and HMI communications that is occurring in the controller, as well as program structures, for example, motion, periodic tasks, and event tasks.

Performance Data Tables

The following tables show the performance of the CompactFlash card in varying instances.

Access 450 Bytes

This table shows the baseline performance of the CompactFlash card. The application code as it is shipped was used to access 450 bytes. All data shown is in ms. Each command was performed 32,000 times and the highest value is shown.

	Create Command	Write Command	Read Command	Delete Command
L6X Controllers	67	187	52	82

Access 4500 Bytes

This table shows the baseline performance of the CompactFlash card. The application code as it is shipped was used to access 4500 bytes. All data shown is in ms. Each command was performed 32,000 times and the highest value is shown.

	Create Command	Write Command	Read Command	Delete Command
L6X Controllers	68	572	178	83

Access 4500 Bytes with an HMI Load

This table shows the baseline performance of the CompactFlash card. The application code as it is shipped was used to access 4500 bytes. Also, a simulated HMI load was added accessing 1500 tags every 500 ms. All data shown is in ms. Each command was performed 32,000 times and the highest value is shown.

	Create Command	Write Command	Read Command	Delete Command
L6X Controllers	74	580	177	84

Access 4500 Bytes with 16 Message Instructions

This table shows the baseline performance of the CompactFlash card. The application code as it is shipped was used to access 4500 bytes. Also, 16 message instructions were added into the application code, each accessing 100 DINT tags from a remote controller. All data shown is in ms. Each command was performed 32,000 times and the highest value is shown.

	Create Command	Write Command	Read Command	Delete Command
L6X Controllers	110	1093	483	103

Access 4500 Bytes and Periodic Tasks

This table shows the baseline performance of the CompactFlash card. The application code as it is shipped was used to access 4500 bytes. The task that contains the CompactFlash code was made into a periodic task that executes every second. All data shown is in ms. Each command was performed 32,000 times and the highest value is shown.

	Create Command	Write Command	Read Command	Delete Command
L6X Controllers	4001	33000	29000	1001

Troubleshoot the CompactFlash File System

Introduction

This appendix describes possible troubleshooting topics you might encounter while using the CompactFlash file system.

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Status User-defined Data Type

For each command that the application supports there is a status user-defined data type created. These are found in the Controller Scoped tags.

Command	Controller Scoped Tag
Create a file	CF_Create_Seq_Status
Write to a file	CF_Write_Seq_Status
Read from a file	CF_Read_Seq_Status
Delete a file	CF_Delete_Seq_Status

The formats of these are generally the same, it depends on the number of steps in each command. This example describes the CF_Write_Seq_Status tag.

[-] CF_Write_Seq_Status	CF_Write_Seq_Status		
▶ [+ CF_Write_Seq_Status.Parse_Data	Sequence_Status		
[+] CF_Write_Seq_Status.File_Open	Sequence_Status		
[+] CF_Write_Seq_Status.Set_Point	Sequence_Status		
[+] CF_Write_Seq_Status.Write_Data	Sequence_Status		
[+] CF_Write_Seq_Status.Close_File	Sequence_Status		
[+] CF_Write_Seq_Status.Read_File	Sequence_Status		
[+] CF_Write_Seq_Status.Verify_Check_Sum	Sequence_Status		
[+] CF_Write_Seq_Status.Overall_Status	DINT	Decimal	

Tag Layout

In the write sequence, there are seven major steps and one overall status. The CF_Write_Seq_Status.Parse_Data status has been expanded to show its format. After a command has been executed, you will want to check the overall status.

	CF_Write_Seq_Status	CF_Write_Seq_Status	
	CF_Write_Seq_Status.Parse_Data	Sequence_Status	
	CF_Write_Seq_Status.Parse_Data.Status	DINT	Decimal
	CF_Write_Seq_Status.Parse_Data.Mes...	DINT	Hex
	CF_Write_Seq_Status.Parse_Data.Mes...	DINT	Hex
	CF_Write_Seq_Status.Parse_Data.Seq...	DINT	Decimal

The following table lists the codes that will appear in the overall status.

Code	Description
0	The command has not been run or is currently running.
1	The command executed without errors.
2	The command ran with errors and you will need to expand each individual sequence and check its Status element.
3	A checksum error has been found. This will only occur for the read and write commands. This means that a read or write was attempted four times and failed the checksum verification.
8	No CompactFlash card was present when a command was executed. The command will not be attempted.

Codes that will appear in the individual sequence status when a 2 appears in the overall status:

4	A file size mismatch occurred. If it is a read command than the tag data_read is too small. If it is a write command than data_to_write is too small. Increase the size of the array.
5	The number of Bytes_to_RW was set to zero.
6	A message instruction involved in this sequence errored. Look at the Message_Error and Message_Error_Extended elements.
7	No file name was entered.

Message Error Codes

The following table lists the error codes that you might see when working with the CompactFlash file system. All error codes are in hex.

Error / Extended	Extended Error Description
0C/0	File does not exist. Invalid handle (State conflict).
05/00	Card removed while command was active.
02/0	Media does not have the free space to create the new file.
0D/0	File already exists.
0C/0	File does not exist (Delete command).
10/0	Device State Conflict: the flash card is not formatted.
13/0	Insufficient command data: the command packet does not contain enough data.
FF/2100	Privilege failure.

For other error codes refer to Logix5000 Controllers General Instructions, publication 1756-RM003.

Notes:

Expand the Code to Support More than 4500 Bytes of Data

Introduction

This appendix describes how to expand the code to support more than 4500 bytes of data.

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Modify the Application to Access More Data

The baseline application supports reading or writing 4500 bytes of data to CompactFlash card. If you need to access more data, modify the baseline application.

For example, you might have three groups of data that you want to write to the CompactFlash card. One group will be 250 bytes, one will be 3000 bytes, and the last will be 10,000 bytes. The first two will not warrant any changes to the baseline application, but the last will. You will need to expand three tag's array sizes.

Before writing to the CompactFlash card, calculate how big to make those three arrays. Do not increase them to 10,000 bytes. Be sure to take into consideration that of the 450 bytes, 8 bytes are checksum information, leaving 442 bytes for user data.

Step 1:

$$\text{Actual_Bytes_to_RW} = \text{Bytes_to_RW} + (\text{TRN}(\text{Bytes_to_RW}/442) * 8) + (\text{If the MOD}(\text{Bytes_to_RW}/442) > 0 \text{ then } 8 \text{ else } 0)$$

Step 2:

$$450 \lceil \text{TRN}(\text{Actual_Bytes_to_RW}/450) \rceil + (\text{if the MOD}(\text{Actual_Bytes_to_RW}) > 0 \text{ then } 1 \text{ else } 0)$$

Access 10,000 Bytes Example

For example, if you want to access 10,000 bytes:

Step 1:

$$\text{Actual_Bytes_to_RW} = 10,000 + (\text{TRN}(10,000/442) * 8) + (\text{If the MOD}(10,000/442) > 0 \text{ then } 8 \text{ else } 0)$$

$$= 10,000 + 22(8) + 8$$

$$= 10,184$$

Step 2:

$$450[(\text{TRN}(10,184/450)) + (\text{If the MOD}(10,148/450) > 0 \text{ then } 1 \text{ else } 0)]$$

$$= 450 [22+1]$$

$$= 450(23)$$

$$= 10350 \text{ bytes}$$

You need to increase the arrays to a minimum of 10,350 elements. Do not place this value in the Actual_Bytes_to_RW. This value is calculated when a file command is executed.

Modify the Arrays

The arrays that will need modification are in the program scope:

- data_read
- data_to_write
- UDT CF_File_Structure

The third change to make is the definition of the UDT CF_File_Structure, shown below.

Name	Data Type	Style	Description
File_Name	String140		This is the file name. Remember to add a file extension. For example .dat
String_Length	INT	Decimal	
File_Handle	DINT	Decimal	Do not manipulate this value
Bytes_to_RW	DINT	Decimal	Enter the number of bytes you want to write to the file
Actual_Bytes_to	DINT	Decimal	Do not manipulate this value
Chunks_to_RW	DINT	Decimal	Do not manipulate this value
Point_Method	DINT	Decimal	Do not manipulate this value
Pointer_Offset	DINT[2]	Decimal	Do not manipulate this value
Point_Move_Len	DINT	Decimal	Do not manipulate this value
Point_Last_Positi	DINT	Decimal	Do not manipulate this value
Commands	DINT	Decimal	Do not manipulate this value
Spare	DINT	Decimal	
Data	SINT[4950]	Decimal	This is the data that is written/read

Data Element

Modify the Data Element

You will need to modify the Data element. This will modify all usage of this data type throughout the application.

Notes:



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Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning, it may need to be returned.

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

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